

<110> Organization Name : Carlsberg A/S

Application Project

-----

<120> Title : Barley for production of flavor-stable beer

<130> AppFileReference : 1

<140> CurrentAppNumber :

<141> CurrentFilingDate : \_\_\_\_-\_\_\_\_-\_\_\_\_

Sequence

-----

<213> OrganismName : Hordeum vulgare cv. Barke

<400> PreSequenceString :

atgctgctgg gagggctgat cgacaccctc acggggggcga acaagagcgc ccggctcaag	60
ggcacggtgg tgctcatgcg caagaacgtg ctggacctca acgacttcgg cgccaccatc	120
atcgacggca tcggcgagtt cctcggcaag ggcgtcacct gccagcttat cagctccacc	180
gccgtcgacc aaggtaaatca ctaccctcct ccggccttct cctctgttta caagatatag	240
tatttctttc gtgtgggccc gcggccatgg atggatggat gtgtctggat cggctaaaga	300
agataggata gctagccctg gccggtcgtc tttaacctgag catgggcata tgccatcgaa	360
aaaagagaca acagcatgca tgcatggtgc gcgcaccaga ccacgcagag caccggatgc	420
tcgagacaaa gcaacacaac aagcaaggac gacacgtcaa aagcaacaca acaagcaagg	480
acggcacgtc aaaagcaaca caaacctaaa cttaaagcaca aagacgtaag agcaagcaca	540
caatcagcag gctataaaca gttgtcatca aaaacaacgc tggaagagag agagaaggaa	600
ggaagtagta gccatgaaaa attaaatcac cgggcgttgc tctttgccc acaattaatc	660
aagcaggata cgtggcatgt atagttcttg taagtaaact aagcatgtga tatgagaagg	720
tacgtggtgg tgcagacaac ggcggtcgcg ggaagggtgg cgcgaggcgc gagctggagc	780
agtgggtgac gagcctgccg tcgctgacga cgggggagtc caagttcggc ctacacctcg	840
actgggaggt ggagaagctc ggggtgccgg gcgccatcgt cgtcaacaac taccacagct	900
ccgagttcct gcttaaaacc atcacctcct acgacgtccc cggccgcagc ggcaacctca	960
ccttcgtcgc caactcatgg atctaccccg ccgccaacta ccgatacagc cgggtcttct	1020
tcgccaacga cgtgcgtgga ttttcctcta ctttcctctc ctttcatttt caccgccttc	1080
gtcattcatg gtcgatcatt aagtcttgcc aggacaatag atgatgagct aggagtgggt	1140
accacttagc agtacgtaca ttatttattc cgtgttggtg gaaaaggata tggtttggtg	1200
cagatcgaca caagattgaa tgaaagttgc accgtggcac cgtggcagcg tggtaggtga	1260
aaataactgt tgcacggatc caccacatg attgttttca tgaataaact ttttaaggat	1320
gtgtctagcc acatctagat gcatgtcaca taattattgc ataccaaaac gattaaatta	1380
agcataaaaa gaaaaggaaa aaaatactca catatctcga cgtaagatca atgatatagt	1440
atttagatat gcaatattta tcttacatct aaacctttct tcatttcctaa atataagaca	1500
tttgtaagat ttcactatgg acaacatacg aaacaaaatc agtggatctc tctatgcatt	1560

cattatgtag	tctataataa	aatctttaa	agatcgtata	ttttgcaacg	gagggagtaa	1620
aacataactt	tttaatagta	atgttgcacg	gctccacact	cgcagacgta	cctgccgagc	1680
cagatgccgg	cggcgctgaa	gccgtaccgc	gacgacgagc	tccggaacct	gcgtggcgac	1740
gaccagcagg	gcccgtacca	ggagcacgac	cgcattctacc	gctacgacgt	ctacaacgac	1800
ctcggcgagg	gccgccccat	cctcggcggc	aactccgacc	acccttacc	gcgcgcggc	1860
cgcacggagc	gcaagcccaa	cgcacgacg	cgcagcctgg	agagccggct	gtcgtgctg	1920
gagcagatct	acgtgccgcg	ggacgagaag	ttcggccacc	tcaagacgtc	cgacttcctg	1980
ggctactcca	tcaaggccat	cacgcagggc	atcctgccgg	ccgtgcgcac	ctacgtggac	2040
accacccccg	gcgagttcga	ctccttcacg	gacatcatca	acctctatga	gggcggcatc	2100
aagctgcccc	aggtggccgc	cctggaggag	ctccgtaagc	agttcccgct	ccagctcatc	2160
aaggacctcc	tcccgcgcg	cggcgactcc	ctgcttaagc	tcccgcgcg	ccacatcatc	2220
caggagaaca	agcaggcgtg	gaggaccgac	gaggagttcg	cacgggaggt	gctcgcggc	2280
gtcaaccggg	tcatgatcac	gcgtctcacg	gtgagtcagc	gattatttgt	tcatttgttg	2340
tgtatggtgt	ccatggtgag	aaagtgcaga	tcttgatttg	cgttgggtcg	catgcacgca	2400
tgctgcatgc	atgcaggagt	tcccgcctaa	aagtagtctg	gaccctagca	agtttggtga	2460
ccacaccagc	accatcacgg	cggagcacat	agagaagaac	ctcgaggggc	tcacggtgca	2520
gcaggttaatt	ggtccaagcc	atcgacatca	actatgatct	acctaggagt	aattggtagc	2580
tgtagataat	ttggcttcgt	tgcaattaat	ttgatgctgg	ccgatcaagt	gatcgtattg	2640
ggtttgaaat	ttgcaggcgc	tggaaagcaa	caggctgtac	atccttgatc	accatgaccg	2700
gttcatgcgc	ttcctgatcg	acgtcaacaa	cctgcccggc	aacttcatct	acgccacgag	2760
gacctctctc	ttcctgcgcg	gcgacggcag	gtcacgcgcg	ctcgccatcg	agctgagcga	2820
gcccacatc	cagggcggcc	ttaccacggc	caagagcaag	gtttacacgc	cggtgcccag	2880
cggctccgtc	gaaggctggg	tgtgggagct	cgccaaggcc	tacgtcgcgc	tcaatgactc	2940
cgggtggcac	cagctcgtca	gccactggta	cgttctccac	ggtcgatgtg	attcagtcag	3000
tcgatgcaca	acaactgatc	gaaatatgat	tgattgaaac	gcgcaggctg	aacactcacg	3060
cgggtgatgga	gccgttcgtg	atctcgacga	accggcacct	tagcgtgacg	caccgcgtgc	3120
acaagctgct	gagcccgcac	taccgcgaca	ccatgaccat	caacgcgctg	gcgcggcaga	3180
cgtcatcaaa	cgccggcggc	atcttcgaga	tgacgggtgt	cccgggcaag	ttcgcgttgg	3240
ggatgtcggc	cgtggtgtac	aaggactgga	agttcaccga	gcagggactg	ccggacgatc	3300
tcatcaagag	gtacgtacct	ggtaaagtgt	atgaatgtgt	aaaacaaatt	gggcgtctcg	3360
ctcactgaca	ggaacgtggt	aaaaaaaaatg	caggggcatg	gcgggtggagg	acccgtcgag	3420
cccgtacaag	gtgcggttgc	tgggtgtcga	ctaccgcgtac	gcggcgagacg	ggctggcgat	3480
ctggcacgcc	attgagcagt	acgtgagcga	gtacctggcc	atctactacc	cgaacgacgg	3540
cgtgctgcag	ggcgatacgg	aggtgcaggc	gtgggtggaag	gagacgcgcg	aggtcgggca	3600
cggcgacctc	aaggaccccc	catggtggcc	caagatgcaa	agtgtgcccg	agctggccaa	3660
ggcgtgcacc	accatcatct	ggatcgggtc	ggcgtgcac	gcggcagtc	acttcgggca	3720
gtacccctac	gcgggggttc	tcccgaaccg	gccgacgggtg	agccggcgcc	gcatgccgga	3780
gcccggcacg	gaggagtacg	cggagctgga	gcgcgacccg	gagcgggcct	tcatccacac	3840
catcacgagc	cagatccaga	ccatcatcgg	cgtgtcgtcg	ctggaggtgc	tgtcgaagca	3900

```

ctcctccgac gagctgtacc tcgggcagcg ggacacgccg gagtggacct cggacccaaa 3960
ggccctggag gtgttcaagc ggttcagcga ccggctggtg gagatcgaga gcaaggtggt 4020
gggcatgaac catgaccgag agctcaagaa ccgcaacggc ccggctaagt ttccctacat 4080
gctgctctac cccaacacct ccgaccacaa gggcgccgct gccgggctta ccgccaaggg 4140
catccccaac agcatctcca tctaa 4165

```

<212> Type : DNA

<211> Length : 4165

SequenceName : SEQ ID NO: 1

SequenceDescription : Barley genomic sequence of cv. Barke,  
spanning  
the start and stop codons of the gene encoding LOX-1

Sequence

-----

<213> OrganismName : Hordeum vulgare mutant D112

<400> PreSequenceString :

```

atgctgctgg gagggctgat cgacaccctc acggggggcga acaagagcgc ccggctcaag 60
ggcacgggtgg tgctcatgcg caagaacgtg ctggacctca acgacttcgg cgccaccatc 120
atcgacggca tcggcgagtt cctcggaag ggcgtcacct gccagcttat cagctccacc 180
gccgtcgacc aaggtaatca ctaccctcct ccggccttct cctctgttta caagatatag 240
tatttctttc gtgtgggccc gcggccatgg atggatggat gtgtctggat cggctaaaga 300
agataggata gctagccctg gccggtcgtc ttacctgag catgggcata tgccatcgaa 360
aaaagagaca acagcatgca tgcattggtg gcgcaccaga ccacgcagag caccggatgc 420
tcgagacaaa gcaacacaac aagcaaggac gacacgtcaa aagcaacaca acaagcaagg 480
acggcacgtc aaaagcaaca caaacctaaa ctaaagcaca aagacgtaag agcaagcaca 540
caatcagcag gctataaaca gttgtcatca aaaacaacgc tgggaagagag agagaaggaa 600
ggaagtagta gccatgaaaa attaaatcac cgggcgttgc tctttgcccc acaattaatc 660
aagcaggata cgtggcatgt atagttcttg taagtaaact aagcatgtga tatgagaagg 720
tacgtggtgg tgcagacaac ggcggtcgcg ggaaggtggg cgcggaggcg gagctggagc 780
agtgggtgac gagcctgccg tcgctgacga cgggggagtc caagttcggc ctacacctcg 840
actgggaggt ggagaagctc ggggtgccgg gcgccatcgt cgtcaacaac taccacagct 900
ccgagttcct gcttaaaacc atcaccctcc acgacgtccc cggccgcagc ggcaacctca 960
ccttcgtcgc caactcatgg atctaccccg ccgccaacta ccgatacagc cgcgtcttct 1020
tcgccaacga cgtgcgtgga ttttcctcta ctttcctctc ctttcatttt caccgccttc 1080
gtcattcatg gtcgatcatt aagtcttgcc aggacaatag atgatgagct aggagtgggt 1140
accacttagc agtacgtaca ttatttattc cgtgttggtg gaaaaggata tgggttggtg 1200
cagatcgaca caagattgaa tgaaagtgc accgtggcac cgtggcagcg tggtaggtga 1260
aaataactgt tgcacggatc caccacatg attgttttca tgaataaact ttttaaggat 1320
gtgtctagcc acatctagat gcatgtcaca taattattgc ataccaaaac gattaaatta 1380

```

agcataaaaa	gaaaaggaaa	aaaataactca	catatctcga	cgtaagatca	atgatatatgt	1440
atttagatat	gcaatatatta	tcttacatct	aaacctttct	tcatttcctaa	atataagaca	1500
tttgtaagat	ttcactatgg	acaacatacg	aaacaaaatc	agtggatctc	tctatgcatt	1560
cattatgtag	tctataataa	aatcttttaa	agatcgtata	ttttgcaacg	gagggagtaa	1620
aacataactt	tttaatagta	atgttgccacg	gctccacact	cgcagacgta	cctgccgagc	1680
cagatgccgg	cggcgctgaa	gccgtaccgc	gacgacgagc	tccggaacct	gcgtggcgac	1740
gaccagcagg	gcccgtacca	ggagcacgac	cgcactctacc	gctacgacgt	ctacaacgac	1800
ctcggcgagg	gccgccccat	cctcggcggc	aactccgacc	acccttacct	gcgcgcggc	1860
cgcacggagc	gcaagcccaa	cgcacgacg	cgcagcctgg	agagccggct	gtcgtgctg	1920
gagcagatct	acgtgccgcg	ggacgagaag	ttcggccacc	tcaagacgtc	cgacttcctg	1980
ggctactcca	tcaaggccat	cacgcagggc	atcctgccgg	ccgtgcgcac	ctacgtggac	2040
accacccccg	gcgagttcga	ctccttccag	gacatcatca	acctctatga	gggcggcatc	2100
aagctgcca	aggtggccgc	cctggaggag	ctccgtaagc	agttcccgtc	ccagctcatc	2160
aaggacctcc	tccccgtcgg	cggcgactcc	ctgcttaagc	tccccgtgcc	ccacatcatc	2220
caggagaaca	agcaggcgtg	gaggaccgac	gaggagtctg	cacgggaggt	gctcgccggc	2280
gtcaaccggg	tcatgatcac	gcgtctcacg	gtgagtcacg	gattatttgt	tcatgtgtg	2340
tgtatggtgt	ccatggtgag	aaagtgcaga	tcttgatttg	cgttgggtcg	catgcacgca	2400
tgctgcatgc	atgcaggagt	tcccgccaaa	aagtagtctg	gaccctagca	agtttggtga	2460
ccacaccagc	accatcacgg	cggagcacat	agagaagaac	ctcgagggcc	tcacggtgca	2520
gcaggtaat	ggtccaagcc	atcgacatca	actatgattt	acctaggagt	aattggtagc	2580
tgtagataat	ttggcttcgt	tgcaattaat	ttgatgctgg	ccgatcaagt	gatcgtattg	2640
ggtttgaaat	ttgcaggcgc	tggaaagcaa	caggctgtac	atccttgatc	accatgaccg	2700
gttcatgccg	ttcctgatcg	acgtcaacaa	cctgcccggc	aacttcactc	acgccacgag	2760
gacctcttcc	ttcctgcgcg	gcgacggcag	gctcacgccg	ctcgccatcg	agctgagcga	2820
gcccacatc	cagggcgggc	ttaccacggc	caagagcaag	gtttacacgc	cggtgcccag	2880
cggctccgtc	gaaggctggg	tgtgggagct	cgccaaggcc	tacgtcgccg	tcaatgactc	2940
cgggtggcac	cagctcgtca	gccactggta	cgttctccac	ggtcgatgtg	attcagtcag	3000
tcgatgcaca	acaactgatc	gaaatatgat	tgattgaaac	gcgcaggctg	aacactcacg	3060
cggatgatgga	gccgttcgtg	atctcgacga	accggcacct	tagcgtgacg	cacccggtgc	3120
acaagctgct	gagcccgcac	taccgcgaca	ccatgaccat	caacgcgctg	gcgcggcaga	3180
cgtcatcaa	cgccggcggc	atcttcgaga	tgacgggtgt	cccgggcaag	ttcgcgttgg	3240
ggatgtcggc	cgtggtgtac	aaggactgga	agttcaccca	gcagggactg	ccggacgatc	3300
tcatcaagag	gtacgtacct	ggtaaattgt	atgaatgtgt	aaaacaaatt	gggcgtctcg	3360
ctcactgaca	ggaacgtggt	aaaaaaaaatg	caggggcatg	gcggtggagg	accgctcgag	3420
cccgtacaag	gtgcggttgc	tgggtgcgga	ctaccctgac	gcggcgagcg	ggctggcgat	3480
ctggcacgcc	attgagcagt	acgtgagcga	gtacctggcc	atctactacc	cgaacgacgg	3540
cgtgctgcag	ggcgatacgg	aggtgcaggc	gtgatggaag	gagacgcgcg	aggtcgggca	3600
cggcgacctc	aaggacgccc	catggtggcc	caagatgcaa	agtgtgccgg	agctggccaa	3660
ggcgtgcacc	accatcatct	ggatcgggtc	ggcgtgcat	gcggcagtca	acttcgggca	3720

```
gtacccttac gcggggttcc tcccgaaccg gccgacgggtg agccggcgcc gcatgccgga 3780
gcccggcacg gaggagtacg cggagctgga gcgcgacccg gagcgggcct tcatccacac 3840
catcacgagc cagatccaga ccatcatcgg cgtgtcgctg ctggagggtgc tgtcgaagca 3900
ctcctccgac gagctgtacc tcgggcagcg ggacacgccg gagtggacct cggacccaaa 3960
ggccctggag gtgttcaagc gggtcagcga ccggctgggt gagatcgaga gcaagggtgt 4020
gggcatgaac catgaccggg agtcaagaa ccgcaacggc ccggctaagt ttccctacat 4080
gctgctctac cccaacacct ccgaccacaa gggcgccgct gccgggctta ccgccaaggg 4140
catccccaac agcatctcca tctaa 4165
```

<212> Type : DNA

<211> Length : 4165

SequenceName : SEQ ID NO: 2

SequenceDescription : Barley genomic sequence of mutant D112 spanning the segment, corresponding to the region between the start and stop codons of the gene encoding LOX-1 of cv. Barke

#### Sequence

-----

<213> OrganismName : Hordeum vulgare cv. Barke

<400> PreSequenceString :

```
MLLGGLIDTL TGANKSARLK GTVVLMRKNV LDLNDFGATI IDGIGEFGLGK GVTCQLISST 60
AVDQDNGGRG KVGAEAELEQ WVTSLPSLTT GESKFGLTFD WEVEKLGVPVPG AIVVNHYHSS 120
EFLKKTITLH DVPGRSGNLT FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD 180
ELRNLRGDDQ QGPYQEHDRY YRYDVYNDLG EGRPILGGNS DHPYPRRGRT ERKPNASDPS 240
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEFDSFQDI 300
INLYEGGIKL PKVAALEELR KQFPLQLIKD LLPVGGDSLL KLPVPHIIQE NKQAWRTDEE 360
FAREVLAVGN PVMITRLTEF PPKSSLDPSK FGDHTSTITA EHIEKNLEGL TVQQALESNR 420
LYILDHHRDF MPFLIDVNNL PGNFYIATRT LFFLRGDGRL TPLAIELSEP IIQGGLTTAK 480
SKVYTPVPSG SVEGWVWELA KAYVAVND SG WHQLVSHWLN THAVMEPFVI STNRHLSVTH 540
PVHKLKLSPHY RDTMTINALA RQTLINAGGI FEMTVFPGKF ALGMSAVVYK DWKFTEQGLP 600
DDLIKRGMAV EDPSSPYKVR LLVSDYPYAA DGLAIWHAIE QYVSEYLAIV YPNDGVLQGD 660
TEVQAWWKET REVGHGDLKD APWWPKMQSV PELAKACTTI IWIGSALHAA VNFGQYPYAG 720
FLPNRPTVSR RRMPEPGTEE YAELEDPER AFIHTITSQI QTIIGVSLLE VLSKHSSDEL 780
YLGQRDTPFW TSDPKALEVF KRFSDDLVEI ESKVGMNHD PELKNRNGPA KFPYMLLYPN 840
TSDHKGAAAG LTAKGIPNSI SI 862
```

<212> Type : PRT

<211> Length : 862

SequenceName : SEQ ID NO: 3

SequenceDescription : Protein sequence of full-length LOX-1 protein of cv. Barke

## Sequence

-----

&lt;213&gt; OrganismName : Hordeum vulgare mutant D112

&lt;400&gt; PreSequenceString :

```
MLLGGLIDTL TGANKSARLK GTVVLMRKNV LDLNDFGATI IDGIGEFGLGK GVTCQLISST      60
AVDQDNNGRG KVGAEAELEQ WVTSLPSLTT GESKFGLTFD WEVEKLGVPK AIVVNYYHSS      120
EFLKLTITLH DVPGRSGNLT FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD      180
ELRNLRGDDQ QGPYQEHDRY YRYDVYNDLG EGRPILGGNS DHPYPRRGRT ERKPNASDPS      240
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEFDSFQDI      300
INLYEGGIKL PKVAALIELR KQFPLQLIKD LLPVGGDSLK KLPVPHIIQE NKQAWRTDEE      360
FAREVLAVGN PVMITRLTEF PPKSSLDPSK FGDHTSTITA EHIEKNLEGL TVQQALESNR      420
LYILDHHRDF MPFLIDVNNL PGNFIYATRT LFFLRGDGRL TPLAIELSEP IIQGGLTTAK      480
SKVYTPVPSG SVEGWVWELA KAYVAVND SG WHQLVSHWLN THAVMEPFVI STNRHLSVTH      540
PVHKLLSPHY RDTMTINALA RQTLINAGGI FEMTVFPGKF ALGMSAVVYK DWKFTEQGLP      600
DDLIKRGMAV EDPSSPYKVR LLVSDYPYAA DGLAIWHAIE QYVSEYLAIY YPNDGVLQGD      660
TEVQA                                          665
```

&lt;212&gt; Type : PRT

&lt;211&gt; Length : 665

SequenceName : SEQ ID NO: 4

SequenceDescription : Protein sequence of inactive,  
truncated LOX-1 of mutant D112

## Sequence

-----

&lt;213&gt; OrganismName : Hordeum vulgare cv. Neruda

&lt;400&gt; PreSequenceString :

```
atgctgctgg gagggctgat cgacaccctc acggggggcga acaagagcgc ccggctcaag      60
ggcacgggtg tgctcatgcg caagaacgtg ctggacctca acgacttcgg cgccaccatc      120
atcgacggca tcggcgagtt cctcggcaag ggcgtcacct gccagcttat cagctccacc      180
gccgtcgacc aaggtaatca ctaccctcct cgggccttct cctctgttta caagatatag      240
tattttctttc gtgtggggccg gcggccatgg atggatggat gtgtctggat cggctaaaga      300
agataggata gctagccctg gccggctcgtc tttacctgag catgggcata tgccatcgaa      360
aaaagagaca acagcatgca tgcattggtgc ggcaccaga ccacgcagag caccggatgc      420
tcgagacaaa gcaacacaa aagcaaggac gacacgtcaa aagcaacaca acaagcaagg      480
acggcacgtc aaaagcaaca caaacctaaa ctaaagcaca aagacgtaag agcaagcaca      540
caatcagcag gctataaaca gttgtcatca aaaacaacgc tggaagagag agagaaggaa      600
ggaagtagta gccatgaaaa attaaatcac cgggcgttgc tctttgcca acaattaatc      660
aagcaggata cgtggcatgt atagttcttg taagtaaact aagcatgtga tatgagaagg      720
```

tacgtggtgg	tgcagacaac	ggcggtcgcg	ggaaggtggg	cgcggaggcg	gagctggagc	780
agtgggtgac	gagcctgccg	tcgctgacga	cgggggagtc	caagttcggc	ctcaccttcg	840
actgggaggt	ggagaagctc	gggggtgccg	gcgccatcgt	cgtcaacaac	taccacagct	900
ccgagttcct	gcttaaaacc	atcacccctc	acgacgtccc	cggccgcagc	ggcaacctca	960
ccttcgtcgc	caactcatgg	atctaccccg	cgcccaacta	ccgatacagc	cgcgtcttct	1020
tcgccaaacga	cgtgcgtgga	ttttcctcta	ctttcctctc	ctttcathtt	caccgccttc	1080
gtcattcatg	gtcgatcatt	aagtcttgcc	aggacaatag	atgatgagct	aggagtgggt	1140
accacttagc	agtacgtaca	ttatttatct	cgtgttggtg	gaaaaggata	tggtttggtg	1200
cagatcgaca	caagattgaa	tgaaagttgc	accgtggcac	cgtggcagcg	tggtaggtga	1260
aaataactgt	tgcacggatc	caccacatg	attgttttca	tgaataaact	ttttaaggat	1320
gtgtctagcc	acatctagat	gcatgtcaca	taattattgc	ataccaaaac	gattaaatta	1380
agcataaaaa	gaaaaggaaa	aaaataactc	catatctcga	cgtgaagatc	atgatatagt	1440
atttagatat	gcaatatatta	tcttacatct	aaacctttct	tcatttcctaa	atataagaca	1500
tttgtaagat	ttcactatgg	acaacatacg	aaacaaaatc	agtggatctc	tctatgcatt	1560
cattatgtag	tctataataa	aatcttttaa	agatcgtata	ttttgcaacg	gagggagtaa	1620
aacataactt	tttaatatga	atgttgacg	gtccacact	cgcagacgta	cctgccgagc	1680
cagatgccgg	cggcgctgaa	gccgtaccgc	gacgacgagc	tccggaacct	gcgtggcgac	1740
gaccagcagg	gcccgtagca	ggagcacgac	cgcactctacc	gctacgacgt	ctacaacgac	1800
ctcggcgagg	gccgccccat	cctcggcggc	aactccgacc	acccttacct	gcgccgcggc	1860
cgcacggagc	gcaagcccaa	cgccagcgac	ccgagcctgg	agagccggct	gtcgtgctg	1920
gagcagatct	acgtgccgcg	ggacgagaag	ttcggccacc	tcaagacgtc	cgacttcctg	1980
ggctactcca	tcaaggccat	cacgcagggc	atcctgccgg	ccgtgcgcac	ctacgtggac	2040
accacccccg	gcgagttcga	ctccttccag	gacatcatca	acctctatga	ggcgggcatc	2100
aagctgccca	aggtggccgc	cctggaggag	ctccgtaagc	agttcccgct	ccagctcatc	2160
aaggacctcc	tccccgtcgg	cggcgactcc	ctgcttaagc	tccccgtgcc	ccacatcatc	2220
caggagaaca	agcaggcgtg	gaggaccgac	gaggagtctg	cacgggaggt	gctcgccggc	2280
gtcaaccccg	tcatgatcac	gcgtctcacg	gtgagtcagc	gattathttgt	tcattgtgtg	2340
tgtatggtgt	ccatggtgag	aaagtgcaga	tcttgatttg	cgttgggctg	catgcacgca	2400
tgetgcatgc	atgcaggagt	tcccgccaaa	aagtagtctg	gaccctagca	agtttggtga	2460
ccacaccagc	accatcacgg	cggagcacat	agagaagaac	ctcgaggggc	tcacggtgca	2520
gcaggtaatt	ggtccaagcc	atcgacatca	actatgattt	acctaggagt	aattggtagc	2580
tgtagataat	ttggcttcgt	tgcaattaat	ttgatgctgg	ccgatcaagt	gatcgtattg	2640
ggtttgaaaat	ttgcaggcgc	tggaaagcaa	caggctgtac	atccttgatc	accatgaccg	2700
gttcatgccg	ttcctgatcg	acgtcaacaa	cctgcccggc	aacttcatct	acgccacgag	2760
gacctctctc	ttcctgcgcg	gcgacggcag	gctcacgccg	ctcgccatcg	agctgagcga	2820
gccccatcatc	cagggcgggc	ttaccacggc	caagagcaag	gtttacacgc	cggtgcccag	2880
cggctccgtc	gaaggctggg	tgtgggagct	cgccaaggcc	tacgtcgccg	tcaatgactc	2940
cgggtggcac	cagctcgta	gccactggta	cgttctccac	ggtcgatgtg	attcagtcag	3000
tcgatgcaca	acaactgatc	gaaatatgat	tgattgaaac	gcgcaggctg	aacactcacg	3060

```

cggatgatgga gccgttcgtg atctcgacga accggcacct tagcgtgacg cacccggtgc 3120
acaagctgct gagcccgac taccgcgaca ccatgaccat caacgcgctg gcgcggcaga 3180
cgctcatcaa cgccggcggc atcttcgaga tgacgggtgtt cccgggcaag ttgcggttgg 3240
ggatgtcggc cgtggtgtac aaggactgga agttcaccga gcaaggactg ccggacgatc 3300
tcatcaagag gtacgtacct ggtaaagtgt atgaatgtgt aaaacaaatt gggcgtctcg 3360
ctcactgaca ggaacgtggt aaaaaaatg caggggcatg gcggtggagg acccgtcgag 3420
cccgtaaaag gtgcgggttc tggtgtcggc ctaccctgac gcggcggacg ggctggcgat 3480
ctggcacgcc attgagcagt acgtgagcga gtacctggcc atctactacc cgaacgacgg 3540
cgtgctgcag ggcgatacgg aggtgcaggc gtggtggaag gagacgcgcg aggtcgggca 3600
cggcgacctc aaggacgccc catggtggcc caagatgcaa agtgtgccgg agctggccaa 3660
ggcgtgcacc accatcatct ggatcgggtc gcgctgcat gcggcagtca acttcgggca 3720
gtacccttac gcgggggttc tcccgaaccg gccgacggtg agcggcgcc gcgtgccgga 3780
gcccggcacg gaggagtacg cggagctgga gcgcgacctg gagcgggctt tcatccacac 3840
catcacgagc cagatccaga ccatcatcgg cgtgtcgctg ctggagggtg tgctgaagca 3900
ctcctccgac gagctgtacc tcgggcagcg ggacacgccg gagtggacct cggacccaaa 3960
ggccttgag gtgttcaagc ggttcagcga cgggctggtg gagatcgaga gcaaggtggt 4020
gggcatgaac catgaccggg agctcaagaa ccgcaacggc ccggctaagt ttccctacat 4080
gctgctctac cccaacacct ccgaccacaa gggcgccgct gccgggctta ccgccaaggg 4140
catccccaac agcatctcca tctaa 4165

```

<212> Type : DNA

<211> Length : 4165

SequenceName : SEQ ID NO: 5

SequenceDescription : Barley genomic sequence of cv. Neruda spanning the start and stop codons of the gene encoding LOX-1

#### Sequence

-----

<213> OrganismName : Hordeum vulgare mutant A618

<400> PreSequenceString :

```

atgctgctgg gagggctgat cgacaccctc acgggggcca acaagagcgc ccggctcaag 60
ggcacgggtg tgctcatgcg caagaacgtg ctggacctca acgacttcgg cgccaccatc 120
atcgacggca tcggcgagtt cctcggcaag ggcgtcacct gccagcttat cagctccacc 180
gccgtcgacc aaggtaatca ctaccctcct ccggccttct cctctgttta caagatatag 240
tatttctttc gtgtgggccc gcggccatgg atggatggat gtgtctggat cggctaaaga 300
agataggata gctagccctg gccggtcgtc ttacctgag catgggcata tgccatcgaa 360
aaaagagaca acagcatgca tgcatggtgc gcgcaccaga ccaagcagag caccggatgc 420
tcgagacaaa gcaacacaac aagcaaggac gacacgtcaa aagcaacaca acaagcaagg 480
acggcacgtc aaaagcaaca caaacctaaa ctaaagcaca aagacgtaag agcaagcaca 540
caatcagcag gctataaaca gttgtcatca aaaacaacgc tggaagagag agagaaggaa 600

```



ggaagtagta	gccatgaaaa	attaaatcac	cgggcgttgc	tctttgcca	acaattaatc	660
aagcaggata	cgtggcatgt	atagttcttg	taagtaaact	aagcatgtga	tatgagaagg	720
tacgtggtgg	tgcagacaac	ggcggtcgcg	ggaagggtgg	cgcggaggcg	gagctggagc	780
agtgggtgac	gagcctgccg	tcgctgacga	cgggggagtc	caagttcggc	ctcaccttcg	840
actgggaggt	ggagaagctc	gggggtgccg	gogccatcgt	cgtcaacaac	taccacagct	900
ccgagttcct	gcttaaaacc	atcacctcc	acgacgtccc	cggccgcagc	ggcaacctca	960
ccttcgtcgc	caactcatgg	atctacccc	cgcgaacta	ccgatacagc	cgcgtcttct	1020
tgcgcaacga	cgtgcgtgga	ttttcctcta	ctttcctctc	ctttcattht	caccgccttc	1080
gtcattcatg	gtcgatcatt	aagtcttgcc	aggacaatag	atgatgagct	aggagtgggt	1140
accacttagc	agtacgtaca	ttattttatt	cgtgttggtg	gaaaaggata	tgggttggtg	1200
cagatcgaca	caagattgaa	tgaaagttgc	accgtggcac	cgtggcagcg	tggtaggtga	1260
aaataactgt	tgcacggatc	caccacatg	attgttttca	tgaataaact	ttttaaggat	1320
gtgtctagcc	acatctagat	gcatgtcaca	taattattgc	ataccaaaac	gattaaatta	1380
agcataaaaa	gaaaaggaaa	aaaatactca	catatctcga	cgtaatatca	atgatatagt	1440
atttagatat	gcaatattta	tcttacatct	aaacctttct	tcattcctaa	atataagaca	1500
tttgtaagat	ttcactatgg	acaacatacg	aaacaaaatc	agtggatctc	tctatgcatt	1560
cattatgtag	tctataataa	aatcttttaa	agatcgtata	ttttgcaacg	gagggagtaa	1620
aacataactt	tttaatagta	atgttgacg	gctccacact	cgcagacgta	cctgccgagc	1680
cagatgccgg	cggcgtgaa	gccgtaccgc	gacgacgagc	tccggaacct	gcgtggcgac	1740
gaccagcagc	gcccgtacca	ggagcacgac	cgcacatctc	gctacgacgt	ctacaacgac	1800
ctcggcgagg	gccgccccat	cctcggcggc	aactccgacc	accttacc	gcgcgcggc	1860
cgcacggagc	gcaagcccaa	cgcacgacg	cgcagccctg	agagccggct	gtcgtgctg	1920
gagcagatct	acgtgccg	ggacgagaag	ttcggccacc	tcaagacgtc	cgacttcctg	1980
ggctactcca	tcaaggccat	cacgcagggc	atcctgcgg	cgtgcgcac	ctacgtggac	2040
accacccccg	gcgagttcga	ctccttcag	gacatcatca	acctctatga	gggcggcatc	2100
aagctgcca	aggtggccgc	cctggaggag	ctccgtaagc	agttcccgtc	ccagctcatc	2160
aaggacctcc	tccccgtcgg	cggcgactcc	ctgcttaagc	tccccgtgcc	ccacatcatc	2220
caggagaaca	agcaggcgtg	gaggaccgac	gaggagtctg	cacgggaggt	gctcgcggc	2280
gtcaaccccg	tcatgatcac	gcgtctcacg	atgagtcagc	gattatttgt	tcatgtgtg	2340
tgtatggtgt	ccatggtgag	aaagtgcaga	tcttgatttg	cgttgggtcg	catgcacgca	2400
tgctgcatgc	atgcaggagt	ttccgcaaaa	aagtagtctg	gacctagca	agtttggtga	2460
ccacaccagc	accatcacgg	cggagcacat	agagaagaac	ctcaggggcc	tcacggtgca	2520
gcaggtaatt	ggtccaagcc	atcgacatca	actatgattt	acctaggagt	aattggtagc	2580
tgtagataat	ttggcttcgt	tgcaattaat	ttgatgctgg	ccgatcaagt	gacgtatttg	2640
ggtttgaaat	ttgcaggcgc	tggaagcaa	caggctgtac	atccttgatc	accatgaccg	2700
gttcatgccg	ttcctgatcg	acgtcaacaa	cctgcccggc	aacttcattc	acgccacgag	2760
gacctcttcc	ttcctgcgcg	gcgacggcag	gctcacgccg	ctcgccatcg	agctgagcga	2820
gcccatcatc	cagggcgggc	ttaccacggc	caagagcaag	gtttacacgc	cggtgccag	2880
cggctccgtc	gaaggctggg	tgtgggagct	cgcgaaggcc	tacgtcgccg	tcaatgactc	2940

```

cgggtggcac cagctcgtca gccactggta cgttctccac ggtcgatgtg attcagtc ag      3000
tcgatgcaca acaactgatc gaaatatgat tgattgaaac gcgcaggctg aacactca cg      3060
cgggtgatgga gccgttcgtg atctcgacga accggcacct tagcgtgacg cacccggt gc      3120
acaagctgct gagcccgcac taccgcgaca ccattgacat caacgcgctg gcgcggcaga      3180
cgctcatcaa cgccggcggc atcttcgaga tgacgggtgtt cccgggcaag ttcgcgtt gg      3240
ggatgtcggc cgtggtgtac aaggactgga agttcaccga gcagggactg ccggacgata      3300
tcatcaagag gtacgtacct ggtaaagtgt atgaatgtgt aaaacaaatt gggcgtct cg      3360
ctcactgaca ggaacgtggt aaaaaaatg caggggcatg gcggtggagg acccgtcgag      3420
cccgatacaag gtgcggttgc tgggtgcgga ctaccgctac gcggcgacg gcggtggagat      3480
ctggcacgcc attgagcagt acgtgagcga gtacctggcc atctactacc cgaacgacgg      3540
cgtgctgcag ggcgatacgg aggtgcaggc gtggtggaag gagacgcgcg aggtcgggca      3600
cggcgacctc aaggacgccc catggtggcc caagatgcaa agtgtgccgg agctggccaa      3660
ggcgtgcacc accatcatct ggatcgggtc ggcgctgcat gcggcagtca acttcgggca      3720
gtacccttac gcgggggttc tcccgaaccg gccgacggtg agccggcgcc gcatgccgga      3780
gcccggcacg gaggagtacg cggagctgga gcgcgacccg gagcgggcct tcatccacac      3840
catcacgagc cagatccaga ccatcatcgg cgtgtcgtc ctggaggtgc tgtcgaagca      3900
ctcctccgac gagctgtacc tcgggcagcg ggacacgccg gaggggacct cggacccaaa      3960
ggcctggag gtgttcaagc ggttcagcga ccggctggtg gagatcgaga gcaagggtgt      4020
gggcatgaac catgaccgag agctcaagaa ccgcaacggc ccggctaagt tccctacat      4080
gctgctctac cccaacacct ccgaccacaa ggcgcgcgct gccgggctta ccgccaaggg      4140
catccccaac agcatctcca tctaa                                         4165

```

<212> Type : DNA

<211> Length : 4165

SequenceName : SEQ ID NO: 6

SequenceDescription : Barley genomic sequence of mutant A618, spanning the segment corresponding to the region between the start and stop codons of the gene encoding LOX-1 of cv. Neruda

Sequence

-----

<213> OrganismName : Hordeum vulgare cv. Neruda

<400> PreSequenceString :

```

MLLGGLIDTL TGANKSARLK GTVVLMRKNV LDLNDFGATI IDGIGEFLLGK GVTCQLISST      60
AVDQDNGGRG KVGAEAELEQ WVTSLPSLTT GESKFGLTFD WEVEKLGVPV AIVVNNYHSS      120
EFLKLTITLH DVPGRSGNLT FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD      180
ELRNLRGDDQ QGPYQEHDRY YRYDVYNDLG EGRPILGNS DHPYPRRGRT ERKPNASDPS      240
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGFDSFQDI      300
INLYEGGIKL PKVAALBELR KQFPLQLIKD LLPVGGDSLL KLPVPPIIQE NKQAWRTDEE      360
FAREVLGVN PVMITRLTEF PPKSSLDPSK FGDHTSTITA EHIEKNLEGL TVQQALESNR      420

```

LYILDHHDHF MPFLIDVNNL PGNFIYATRT LFFLRGDGRL TPLAIELSEP IIQGGLTTAK 480  
SKVYTPVPSG SVEGWVWELA KAYVAVNDSG WHQLVSHWLN THAVMEPFVI STNRHLSVTH 540  
PVHKLLSPHY RDTMTINALA RQTLINAGGI FEMTVFPGKF ALGMSAVVYK DWKFTEQGLP 600  
DDLIKRGMAV EDPSSPYKVR LLVSDYPYAA DGLAIWHAIE QYVSEYLAIY YPNDGVLQGD 660  
TEVQAWWKET REVGHGDLKD APWWPKMQSV PELAKACTTI IWIGSALHAA VNFGQYPYAG 720  
FLPNRPTVSR RRMPEPGTEE YAELEDPER AFIHTITSQI QTIIGVSLLE VLSKHSSDEL 780  
YLGQRDTPEW TSDPKALEVF KRFSDDLVEI ESKVVGMMND PELKNRNGPA KFPYMLLYPN 840  
TSDHKGAAAG LTAKGIPNSI SI 862

<212> Type : PRT

<211> Length : 862

SequenceName : SEQ ID NO: 7

SequenceDescription : Protein sequence of full-length

LOX-1 protein of cv. Neruda

#### Sequence

-----

<213> OrganismName : Hordeum vulgare mutant A618

<400> PreSequenceString :

MLLGGLIDTL TGANKSARLK GTVVLMRKNV LDLNDFGATI IDGIGEFLGK GVTCQLISST 60  
AVDQDNNGRG KVGAEAELEQ WVTSLPSLTT GESKFGLTFD WEVEKLGVPK AIVVNNYHSS 120  
EFLKLTITLH DVPGRSGNLT FVANSWIYPA ANYRYSRVFF ANDTYLPSQM PAALKPYRDD 180  
ELRNLRGDDQ QGPYQEHDRY YRYDVYNDLG EGRPILGGNS DHPYPRRGRT ERKPNASDPS 240  
LESRLSLLEQ IYVPRDEKFG HLKTSDFLGY SIKAITQGIL PAVRTYVDTT PGEFDSFQDI 300  
INLYEGGIKL PKVAALEELR KQFPLQLIKD LLPVGGDSLK KLPVPPIIQE NKQAWRTDEE 360  
FAREVLGVN PVMITRLTMS QRLFVHCVCV VSMVRKCRS 399

<212> Type : PRT

<211> Length : 399

SequenceName : SEQ ID NO: 8

SequenceDescription : Protein sequence of inactive,  
truncated LOX-1 of mutant A618

#### Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

gaaagcgagg agaggaggcc aagaacaa 28

<212> Type : DNA

<211> Length : 28

SequenceName : SEQ ID NO: 9

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

ttattcatcc atggttgccg atggcttaga

30

<212> Type : DNA

<211> Length : 30

SequenceName : SEQ ID NO: 10

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

agggactgcc ggacgatctc a

21

<212> Type : DNA

<211> Length : 21

SequenceName : SEQ ID NO: 11

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

gccagctccg gcacactt

18

<212> Type : DNA

<211> Length : 18

SequenceName : SEQ ID NO: 12

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :  
caaggtgcgg ttgctggtgt c 21  
<212> Type : DNA  
<211> Length : 21  
SequenceName : SEQ ID NO: 13  
SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
ctcgcgcgtc tccttccac 19  
<212> Type : DNA  
<211> Length : 19  
SequenceName : SEQ ID NO: 14  
SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer) Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
ctcgcgcgtc tccttccat 19  
<212> Type : DNA  
<211> Length : 19  
SequenceName : SEQ ID NO: 15  
SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

Sequence  
-----  
<213> OrganismName : Oligonucleotide  
<400> PreSequenceString :  
tacgtgccgc gggacgagaa g 21  
<212> Type : DNA  
<211> Length : 21  
SequenceName : SEQ ID NO: 16  
SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

## Sequence

-----

&lt;213&gt; OrganismName : Oligonucleotide

&lt;400&gt; PreSequenceString :

tgatcatgac cgggttgacg t

21

&lt;212&gt; Type : DNA

&lt;211&gt; Length : 21

SequenceName : SEQ ID NO: 17

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

## Sequence

-----

&lt;213&gt; OrganismName : Oligonucleotide

&lt;400&gt; PreSequenceString :

catatgctgc tgggagggt g

21

&lt;212&gt; Type : DNA

&lt;211&gt; Length : 21

SequenceName : SEQ ID NO: 18

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

## Sequence

-----

&lt;213&gt; OrganismName : Oligonucleotide

&lt;400&gt; PreSequenceString :

gaattcttag atggagatgc tggtggg

27

&lt;212&gt; Type : DNA

&lt;211&gt; Length : 27

SequenceName : SEQ ID NO: 19

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)

## Sequence

-----

&lt;213&gt; OrganismName : Oligonucleotide

&lt;400&gt; PreSequenceString :

ctacccgtac gcggcggacg ggct

24

&lt;212&gt; Type : DNA

<211> Length : 24

SequenceName : SEQ ID NO: 20

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (sense primer)

Sequence

-----

<213> OrganismName : Oligonucleotide

<400> PreSequenceString :

tcctgaattc acgcctgcac ctccgtatcg c

31

<212> Type : DNA

<211> Length : 31

SequenceName : SEQ ID NO: 21

SequenceDescription : Oligonucleotide primer used for PCR  
amplification (antisense primer)